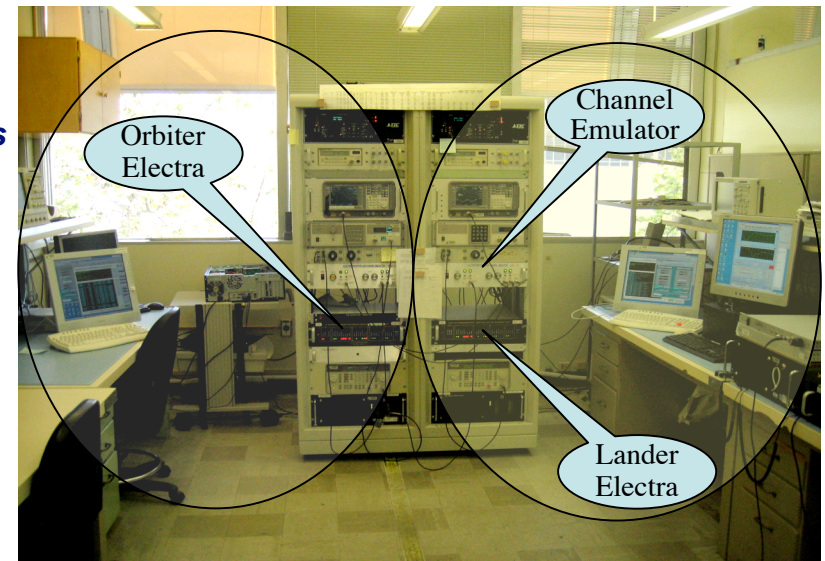
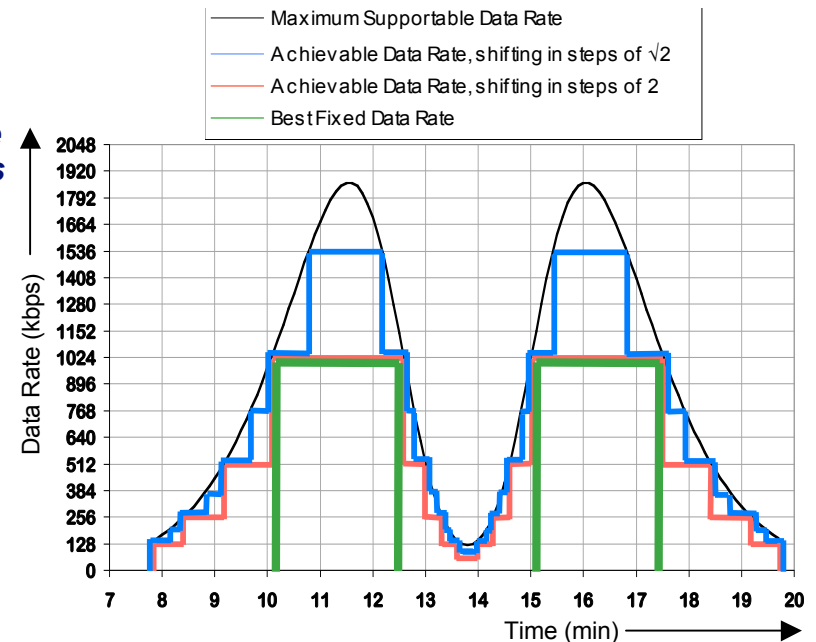




Mars Technology Highlight: *Adaptive Data-Rates for Electra*



- **Background:** Currently, the data rate of communication between a Mars lander and a Mars telecommunications relay orbiter is fixed, with a goal of maximizing data return, before each overhead pass of the orbiter, since the Electra UHF proximity radio is not capable of changing data rate while communicating. As the orbiter passes overhead, the relative position and distance between the orbiter and the lander change substantially, resulting in a concomitant variation of the radio signal strength, and hence supportable data rate. To maximize data return, the data rate is fixed at a median value between the minimum and maximum instantaneous supportable data rates of the pass. Hence, for about half the pass the radio signal is not strong enough to communicate, while for the other half of the pass the lander sends data to the orbiter at a rate that is lower than the maximum supportable data rate, resulting in “wasted” link margin and reduced data return.
- **Technology:** Since the Electra radio is programmable, an algorithm that continuously monitors the received signal strength and autonomously adapts the communications data rate was developed, tested and implemented on Electra.
- **TRL-6 demonstration:** Two Electra radios were communicating, one transmitting and the other receiving, under varying link conditions. Noise was externally injected into the communications signal and its strength was continuously varied by a custom-designed channel emulator, emulating a realistic orbiter overhead communications pass scenario. The radios successfully sensed and responded to the varying signal-to-noise ratio of the link by autonomously adapting their communications data rate between 32 kbps and 256 kbps. 100% of the communications session data was successfully transmitted!
- **Mission Impact:** This technology has already been adopted by the Mars Science Laboratory. Using this technique, the returned data volume will be increased by up to 80% without any hardware modifications to Electra.



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